

Detection of Cancer of the Lung

Results of a Chest X-ray Survey in Los Angeles

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RECENT RELIABLE REPORTS indicate that there is a real and almost alarming increase in the incidence of bronchogenic carcinoma. The Bureau of Chronic Diseases for the State of California has compiled figures showing an increase in the death rate for cancer of the lung in California from 5 per 100,000 in 1930 to 13.8 per 100,000 in 1950.¹ Cancer of the lung has now replaced gastric carcinoma as the first cause of death from cancer and recent figures indicate that in 1953 there were more deaths from this form of cancer in males than there were from tuberculosis.¹ In addition to the real increase in the frequency of this disease, attention has been focused on this form of cancer because of the controversy with regard to its relationship to smoking. These two factors have thrown the problem of lung cancer into probably undue prominence, perhaps not in professional literature, but certainly in magazines of general circulation.

In the late 1940's interest was developed along the line of extending the already current x-ray screening for tuberculosis to include possible detection of lung cancer. Spearheaded by the United States Public Health Service and in California by the Bureau of Chronic Diseases of the Department of Public Health, the concept of coupling the detection of lung tumor suspects with the procedure of screening for tuberculosis was accepted and placed on a practical footing. The first large x-ray screening in the State of California in which particular attention was paid to suspicion of chest tumor was the one completed in San Diego County in 1949. The results obtained there were so interesting and of such potential benefit that it was felt advisable to extend the experience gathered during that survey.

Accordingly, when the Los Angeles County Mass Chest X-Ray Survey was organized in 1950 primarily for the purpose of detecting tuberculosis, due cognizance was taken of the importance of follow-up of persons suspected of chest tumor who might be discovered in the same x-ray screening. With the approval of the Cancer Committee of the Los Angeles

• In a mass survey by x-ray minifilm in Los Angeles County, apparently suspicion of cancer of the lung was reported in more than 90 per cent of cases in which the condition existed.

Of the patients who were appropriate for resection with intent to cure, 35.8 per cent had "three-year cures." This high cure rate indicates that if the condition is detected early by the survey method and "curative" operation is done, cure rate for lung cancer may be much higher than is usually thought.

County Medical Association and with funds made available by the Bureau of Chronic Diseases of the California Department of Public Health, a Registry was organized into which were placed all possible chest tumor suspects detected in the Los Angeles County Survey to facilitate prompt treatment and to collect and report end results.

This survey was begun early in 1950 and was completed by the end of that year. During that period, a total of 1,867,201 minifilms of persons were taken. More than four years has elapsed since the inception of that mass screening, and more than three years since its completion. Because of the organization of the Chest Tumor Registry and the follow-up that has been continued on these cases, it is now possible to report three-year follow-up figures from this group.

Of the nearly 2,000,000 persons surveyed, 64,745 were asked to return for confirmatory roentgenograms, of whom 54,648 complied. The findings on the confirmatory roentgenograms are shown in Table 1. Of the 5,646 confirmatory roentgenograms designated as showing "Other Chest Disease," exactly 3,500 were deemed as possibly representing chest tumor and as such were placed in the Chest Tumor Registry. This gives an incidence rate for

TABLE 1.—Findings on confirmatory roentgenograms

Essentially negative.....	14,344
Evidence of old healed disease.....	9,216
Tuberculosis	18,785
Cardiovascular disease.....	6,657
"Other chest disease" (included neoplasm suspects)	5,646
Total confirmatory roentgenograms	54,648

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TABLE 2.—Occurrence of possible tumors detected on 14x17-inch chest roentgenograms in ten surveys

City	County Included	State	Persons Examined	No. of Possible Tumors (14x17-in. films)	Rate per 1000 Persons Examined
Savannah.....	Chatham.....	Georgia.....	67,961	43	0.6
	Gaston and Wayne.....	North Carolina.....	84,599	58	0.7
Milwaukee.....		Wisconsin.....	176,469	37	0.2
Minneapolis.....		Minnesota.....	301,513	404	1.3
Washington.....		District of Columbia.....	439,927	373	0.8
Seattle.....	King.....	Washington.....	368,129	261	0.7
Tacoma.....		Washington.....	72,703	32	0.4
Spokane.....		Washington.....	106,526	67	0.6
Salt Lake Area.....		Utah.....	162,351	107	0.7
Total.....			1,780,178	1,382	0.8

tumor suspects of 1.9 per 1,000 examined in the survey. This rate is significantly higher than in other surveys (Table 2) and probably may be attributed to a high index of suspicion in the Los Angeles survey, for the actual incidence of lung cancer in Los Angeles County seems to be somewhat lower than the average for other urban population areas.³

There was rather pronounced delay on the part of both physician and patient in establishing a definite diagnosis in many of these cases. One year after the completion of the survey, one-fourth of the persons in whom tumor was suspect were still in the process of investigation and diagnosis was pending. It has been stated that cancer of the lung is the most readily detectable of the so-called inaccessible or internal cancers. While this is true, one other point in regard to lung cancer should be stressed. This is the fact that "symptomatic or clinical" cancer of the lung is seldom curable. By the time symptoms have developed sufficiently to make the patient aware that something is wrong, the disease has usually progressed to a stage at which it is, if not inoperable, certainly incurable. Cancer of the lung, if it is to be cured, must be treated surgically while it is still in the asymptomatic or preclinical phase. What can be accomplished when it is discovered in the "silent" or asymptomatic phase? Overholt⁵ recently reported that, when prompt treatment followed discovery of cancer in the silent phase by x-ray survey, all lesions were resectable, that 75 per cent showed no evidence of lymphatic spread, and that all patients in this group were still living at the time of his report. In contrast, when the patient and/or the physician waited until there were symptoms, approximately 90 per cent of the lesions had extended beyond the lung and the possibility of cure was less than 10 per cent for this symptomatic group.

The final status of the investigation of the 3,500 persons in whom lung tumor was suspected is shown in Table 3. Most of the categories are self-explanatory. The 117 cases designated as "Other disease, treated," included a miscellaneous group of cases, mostly inflammatory lesions, tuberculomas, dia-

TABLE 3.—Final status of chest tumor suspects

Category	Number	Per Cent
Chest neoplasm ruled out.....	1,955	55.8
Refused treatment	67	1.9
Lost	172	4.9
Goiter	461	13.2
Other disease, treated.....	117	3.3
Lesion metastatic.....	96	2.7
Clinically benign, not treated.....	293	8.4
Confirmed chest neoplasm.....	339	9.7
Total.....	3,500	

TABLE 4.—Classification of neoplasms in cases in which diagnosis was confirmed

Malignant	260
Bronchogenic carcinoma.....	213
Sarcoma and others.....	47
Benign	79
Total confirmed neoplasms.....	339

TABLE 5.—Operative summary for bronchogenic carcinoma with operative mortality (total bronchogenic carcinomas, 213; operability rate, 53 per cent)

	Number of Cases	Operative Deaths	Operative Mortality Per Cent
Total bronchogenic carcinomas operated on	113	8	7.1
Exploratory thoracotomy only	28	1	3.6
Resection:			
Palliative	15	0	0
Curative:			
Lobectomy	20	2	10.0
Pneumonectomy	50	5	10.0

phragmatic hernias, etc. There were a total of 117 major operations, mostly curative in nature, with an operative mortality of only 3.4 per cent.

The group designated as "Tumor, clinically benign, not treated," included all cases in which there was a definite x-ray report of chest tumor, but in which operation was not done because the patient was asymptomatic, and in which the clinical course indicated the tumor was benign. This group in the present study corresponds clinically to a group in another series, reported upon by Overholt,⁶ in which about 45 per cent of "silent" lesions, unverified

TABLE 6.—Status of patients with registered bronchogenic carcinomas as of May 1, 1954

	Untreated Cases	Exploratory Thoracotomy	Palliative Resection	Curative Resection	Total Cases
Total bronchogenic carcinomas.....	100	28	15	70	213
Died, intercurrent disease*.....	.....	.....	.....	3	3
Total determinate cases†.....	100	28	15	67	210
Failures:					
Died of carcinoma.....	99	27	14	33	173
Alive with carcinoma.....	1	0	1	3	5
Operative death.....	.....	1	0	7	8
Lost with disease.....	.....	.....	.....	.....	.....
Successes:					
Alive, free of cancer.....	.....	.....	.....	24	24
3-year "cure rate," per cent.....	0.0	0.0	0.0	35.8	.....

*Not included in determining 3-year cure rate.

†Excludes those dying of intercurrent disease but free of recurrent carcinoma from calculation of end results.

before exploration, were found to be malignant when thoracotomy was done. It is assumed that additional cases of bronchogenic carcinoma will eventually be reported in this group.*

The classification of the neoplasms in cases in which diagnosis of tumor was confirmed is shown in Table 4. Of the 79 patients with benign tumors, 56 were operated upon with intent to cure and there was no operative mortality. The tumors grouped as "sarcoma and others" were mostly lymphomas of the mediastinum or other miscellaneous malignant processes involving the mediastinum.

Data on operation in cases of bronchogenic carcinoma are summarized in Table 5. Operation was done in 113 of the 213 cases of proven bronchogenic lesions, an operability rate of 53 per cent, which compares favorably with operability rates from specialized clinics. Resection was done in 85 cases or 75 per cent of those in which operation was carried out. This is an exceptionally high resection rate and probably reflects the fact that in a relatively large number of cases in the group the lesions were early and asymptomatic. Since 15 of these resections were definitely stated to have been palliative in intent, they were excluded in calculating the end results, which are summarized in Table 6. The three-year "cure rate" of 35.8 per cent for this group of curative operative cases is much higher than the cure rates similarly calculated in other reported series and must be at least partially due to the fact that the group contained a relatively high percentage of early asymptomatic cases discovered in the x-ray survey. It might be argued that by the time five years has elapsed, the conventional time selected for evaluation of end results, the "cure rate" will be substantially lower and in line with other series. This is probably not true. Bronchogenic carcinoma is an aggressive disease and runs a rather rapid and acute course. If there

is to be recurrence, it is usually evident soon after operation. In other series, the three-year and the five-year survival rates are essentially identical.^{2, 4} This leveling off of the recurrence rate after three years has been repeatedly commented upon.

Another factor pointing to the probability that the group included a large number of early lesions is the fact that 79.3 per cent of all bronchogenic lesions in the group were stated to have been discovered by the x-ray survey and hence were probably either asymptomatic or only recently had begun to cause symptoms. One other measure of the effectiveness of a survey method in picking up bronchogenic carcinoma is available. During the years 1950-1952 inclusive, a total of 1,903 persons died of bronchogenic carcinoma in Los Angeles County. These death lists have been checked against the alphabetized lists of those who had minifilms taken in the survey. In 1950, the year of the survey, only 27 persons who had minifilms reported "negative" for chest lesions died of bronchogenic carcinoma. Considering the fact that 213 confirmed bronchogenic lesions were discovered that year through the survey, and that probably in many of the 27 cases "missed" in the survey the roentgenographic evidence of the disease did not develop until after their minifilms had been taken, it is apparent that less than 10 per cent of persons even though harboring early bronchogenic carcinoma will be missed by such an x-ray survey.

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*Since compilation of these figures, six additional cases from this group have been reported to the Registry as being proven cases of bronchogenic carcinoma.